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UTAH HERPETOLOGISTS LEAGUE JOURNAL

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This organization was formed in January of 1974 and incorporated within the state of Utah under the title Utah Herpetologists League, a subsidiary of the Utah Zoological Society. The League is open to all individuals for membership, professional and non-professional alike. The objectives of this organization are as follows:

1. *To work towards conservation of Utah's species of reptiles and amphibians (protection where needed) and State Laws regulating their export and control.*

2. *To educate those interested concerning reptiles and amphibians so a better understanding will increase appreciation of these valuable animals.*

3. *To encourage field studies and laboratory research involving the Utah fauna, encompassing environment, geographical distribution, population dynamics, biologics, etc.....*

4. *To circulate data, photos, experiences, research and other information to the major zoos of this country and other interested institutions.*

Monthly meetings are held on the first Thursday at 7:30 p.m. Meeting location is the Utah Wildlife Resources Building, 1596 West No. Temple, Salt Lake City, Utah. Membership fees are as follows:

Regular Membership:	*5.00/year*
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Members receive the Newsletter and the League Journal and the right to attend all league meetings and participate therein.

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Front Cover Art - *K. S. Matz*, Logo design by *David Jensen*

Outside Back Cover - V. R. L., venom extraction, 13 ft. king cobra (*Ophiophagus hannah*)...photos by *R. C. Straight*

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REPTILES IN THE BIBLE

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A number of reptilian publications have appeared in the past 100 years that include such subject matter as mythology, folklore, idolisms, religious cults and primitive belief (6,7). One area of herpetological interest that has been greatly neglected in the literature is the many references to reptiles in the Bible. The objective of this series of reports is to present all locations in the Bible that directly refer to reptiles and many that indirectly include reptiles also. It is not the intention or desire of the authors to "interpret" but rather to present consise data, using "scholarly definition" of the ancient manuscripts (1,12) written in the Hebrew (*Old Testament*) and Greek (*New Testament*) languages.

The *Holy Bible* (11) and *James Strongs Concordance of the Bible* (9) was examined for the location of all the English language references. A list of significant Hebrew and Greek words meaning reptiles was collected from the concordance. The Hebrew words were then cross referenced in the *Englishman's Hebrew and Chaldee Concordance of the Old Testament* (10). *Unger's Bible Dictionary* (14) was also consulted. Reasonable assurance that consideration of most, if not all of the references in the Bible were obtained by this method. Definitions of words and idiums were obtained from the published reports of *Davidson* (5), *Orlinsky* (8), *Strong* (9), *Cohen* (2,3,4), *Weingreen* (15), *Zondervan* (10), and *The Septuagint* (13). Precise spellings and grammatical forms were established by consulting the *Masoretic text* (12) for the Hebrew, and *Berry's Greek Interlinear* (1) for the Greek New Testament.

The following table lists all the nomenclature used to designate reptiles found in the *Old Testament*. Definitions are those of *Strong* (9), and *Davidson* (5).

TABLE 1

BIBLICAL NOMENCLATURE FOR REPTILES --- *HEBREW*

Hebrew	English Transliteration		Definition
צֶכְשׁוּב	*Acshuve*	*STRONG:*	*To coil, an asp (from lurking coiled-up), an adder*
		DAVIDSON:	*As asp*
אֲנָקָה	*Anakah*	*STRONG:*	*Some kind of lizard, probably the gecko (from its wail)*
		DAVIDSON:	*A kind of lizard*
חֹמֶט	*Chomet*	*STRONG:*	*A lizard*
		DAVIDSON:	*A kind of lizard*
כּוֹחַ	*Coach*	*STRONG:*	*From its hardiness, a large lizard*
		DAVIDSON:	*A species of lizard*
אֶפְעֶה	*Epheh*	*STRONG:*	*An asp or other venomous serpent, viper (in the sense of hissing)*
		DAVIDSON:	*From* אָפַע *; to breathe*
לְטָאָה	*Lettaah*	*STRONG:*	*To hide, a lizard from its covert habits*
		DAVIDSON:	*Species of poisonous lizard*
לִוְיָתָן	*Leviathan*	*STRONG:*	*Serpent, crocodile, dragon*
		DAVIDSON:	*Sea-monster, large serpent, crocodile*
נָחָשׁ	*Nachash*	*STRONG:*	*Snake (from its hiss)*
		DAVIDSON:	*Serpent (enchantment)*
נַשָׁם	*Nahsham*	*STRONG:*	*A hard breather, i.e. the name of two unclean creatures, a lizard and a bird*
		DAVIDSON:	*A species of animal enumerated among the lizards*
פֶּתֶן	*Petten*	*STRONG:*	*From an unused root meaning to twist, an asp (from its contortions): an adder*
		DAVIDSON:	*Asp*
רֶמֶשׂ	*Remmes*	*STRONG:*	*Reptile*
		DAVIDSON:	*Reptile*
שְׂמָמִית	*Samamete*	*STRONG:*	*A lizard*
		DAVIDSON:	*From an unused root, Arabic to poison, a species of poisonous lizard*

שָׂרָף	*Saraph*	*STRONG:*	*Burning, i. e., poisonous serpent, symbolic creature (from their copper color)*
		DAVIDSON:	*To burn, a species of venomous serpent*
שְׁפִיפֹן	*Shaphiphone*	*STRONG:*	*A kind of serpent (as snapping)*
		DAVIDSON:	*From* שָׁפַף *, to creep, serpent Arabic* שַׁף *; a speckled serpent*
תַּנִּים תַּנִּין	*Tannime* *Tannine*	*STRONG:*	*Marine or land monster; sea-serpent;- dragon, serpent*
		DAVIDSON:	*Great serpent,* תָּנָה *-crocodile, serpent*
צָב	*Tsav*	*STRONG:*	*Lizard*
		DAVIDSON:	*Lizard*
צֶפַע צִפְעֹנִי	*Tsephah* *Tsiphone*	*STRONG:*	*From a root meaning to extrude, a viper (as thrusting out the tongue): adder, cockatrice*
		DAVIDSON:	*Basilisk*
זָחַל	*Zachal*	*STRONG:*	*Crawl, to fear, serpent*
		DAVIDSON:	*To creep, crawl*

Table 1 contains the multiple forms (*Tannine* and *Tsiphone*) of the words *Tannime and Tsephah*, respectively and are included because of their individual use in the *Holy Bible*.

The five Greek words defining reptiles listed in Table 2, are found in the *New Testament*. Definitions are those of *Berry* (1) and *Strong* (9).

TABLE 2

BIBLICAL NOMENCLATURE FOR REPTILES --- *GREEK*

Greek	English Transliteration		Definition
ασπιζ	*Aspis*	*STRONG:*	*Round, shield, serpent (as coiling)*
		BERRY:	*An asp, venomous serpent*
δρακων	*Drakon*	*STRONG:*	*Fabulous, fascinating serpent*
		BERRY:	*Dragon, huge serpent*

εχιδνα	*Echidna*	STRONG:	*Adder, poisonous snake, viper*
		BERRY:	*Viper*
ἑρπετον	*Herpeton*	STRONG:	*Reptile, from herpe - To creep*
		BERRY:	*A reptile, creeping creature*
Ὄφις	*Ophis*	STRONG:	*Snake, sharpness of vision, artful malicious person*
		BERRY:	*Serpent*

Tables 3 and 4 are the Hebrew and Greek Concordances listing every occurance of the reptilian terminology contained in Tables 1 and 2. When two reptilian references appear in the same phrase, the word referred to is underlined. Verse terminology is listed as it appears in the *Holy Bible* which may not coincide with the definitions in Table #1 (Example: REMMES)

TABLE 3

HEBREW CONCORDANCE

עַכְשׁוּב = ACSHUVE
Psa 140:3 *adders' poison is under their lips*

אָנָקָה = ANAKAH
Lev 11:30 *and the ferret*

חֹמֶט = CHOMET
Lev 11:30 *and the snail*

כֹּחַ = COACH
Lev 11:30 *and the chameleon*

אֶפְעֶה = EPHEH
Job 20:16 *the viper's tongue shall slay him*
Isa 30:6 *the viper and fiery flying serpent*
59:5 *is crushed breaketh out into a viper*

לְטָאָה = LETTAAH
Lev 11:30 *the chameleon and the lizard*

לִוְיָתָן = LEVIATHAN
Psa 74:14 *thou brakest the heads of leviathan*
104:26 *(there is) that leviathan*
Isa 27:1 *leviathan the piercing serpent, even leviathan that crooked serpent*

נָחָשׁ = NACHASH
Gen 3:1 *the serpent was more subtil*
2 *the woman said unto the serpent*
4 *the serpent said unto the woman*
13 *the serpent beguiled me*
14 *the Lord said unto the serpent*
49:17 *Dan shall be a serpent by the way*
Ex 4:3 *and it became a serpent*
7:15 *the rod which was turned to a serpent*
Num 21:6 *the Lord sent fiery serpents*
7 *that he take away the serpents*

Num 21:9 Moses made a serpent of brass
9 if a serpent had bitten any man
9 when he beheld the serpent of brass
Deut 8:15 fiery serpents
IIKg18:4 the brasen serpent that Moses had made
Job 26:13 his hand hath formed the crooked serpent
Psa 58:4 their poison (is) like the poison of a serpent
140:3 their tongues like a serpent
Prov23:32 biteth like a serpent
30:19 the way of a serpent upon a rock
Ecc 10:8 a serpent shall bite him
11 the serpent will bite without enchantment
Isa 14:29 out of the serpent's roots
27:1 leviathan the piercing serpent, even leviathan that crooked serpent
Isa 65:25 and dust (shall be) the serpent's meat
Jer 8:17 I will send serpents
46:22 the voice thereof shall go like a serpent
Am 5:19 and a serpent bit him
9:3 thence will I command the serpent
Mic 7:17 They shall lick the dust like a serpent

נָחָשׁ = NAHSHAM
Lev 11:30 and the mole

פֶּתֶן = PETTEN
Deut32:33 the cruel venom of asps
Job 20:14 the gall of asps
16 He shall suck the poison of asps
Psa 58:4 the deaf adder
91:13 Thou shalt tread upon the lion and adder
Isa 11:8 on the hole of the asp

רֶמֶשׂ = REMMES
Gen 1:24 cattle, and creeping thing
25 everything that creepeth
26 every creeping thing that creepeth
6:7 the creeping thing, and the fowls
20 every creeping thing of the earth
7:14 every creeping thing that creepeth
23 the creeping things and the fowl
8:17 every creeping thing that creepeth
19 every beast, every creeping thing
9:3 Every moving thing that liveth
I Kg 4:33 He spake also of...creeping things
Psa104:25 things creeping innumerable
148:10 creeping things, and flying fowl
Ezek 8:10 every form of creeping things
38:20 all creeping things that creep
Hos 2:18 and with the creeping things of the ground
Hab 1:14 as the creeping things, that have no ruler

שְׂמָמִת = SAMAMETE
Prov30:28 The spider taketh hold with her hands

שָׂרָף = SARAPH
Num 21:8 Make thee a fiery serpent
Isa 14:29 a fiery flying serpent
30:6 lion, the viper, and fiery flying serpent

שְׁפִיפֹן = SHAPHIPHONE
Gen 49:17 an adder in the path

תַּנִּים = TANNIME
Job 30:29 I am a brother to dragons
Psa 44:19 sore broken us in the place of dragons
Isa 13:22 and dragons in their pleasant palaces
34:13 it shall be an habitation of dragons
35:7 in the habitation of dragons
43:20 shall honor me, the dragons and the owls
Jer 9:11 Jerusalem heaps and a den of dragons
10:22 Judah desolate, and a den of dragons
14:6 snuffed up the wind like dragons
49:33 Hazor shall be a dwelling for dragons
51:37 a dwelling place for dragons
Ezek29:3 the great dragon that lieth in the midst
Mic 1:8 make a wailing like the dragons

תַּנִּין = TANNINE
Ex 7:9 it shall become a serpent
10 it became a serpent
12 and they became serpents
Deut32:33 Their wine is the poison of dragons
Neh 2:13 even before the dragon well
Psa 74:13 Thou brakest the heads of the dragons
91:13 the young lion and the dragon
148:7 ye dragons and all deeps
Isa 27:1 he shall slay the dragon
51:9 and wounded the dragon
Jer 51:34 hath swallowed me up like a dragon

צָב = TSAV
Lev 11:29 and the tortoise after his kind

צֶפַע = TSEPHAH
Isa 14:29 shall come forth a cockatrice

צִפְעֹנִי = TSIPHONI
Prov23:32 stingeth like an adder
Isa 11:8 his hand on the cockatrice' den
59:5 They hatch cockatrice eggs
Jer 8:17 I will send...cockatrices, among you

זָחַל = ZACHAL
Deut32:24 with the poison of serpents of the dust

TABLE 4

GREEK CONCORDANCE

ασπιζ = ASPIS
Rom 3:13 poison of asps is under their lips

δρακων = DRAKON
Rev12:3 great red dragon
4 dragon stood
7 angels faught against the dragon
7 dragon faught and his angels

	Rev	12:9	*dragon was cast out*
		13	*dragon saw he was cast out*
		16	*the flood which the dragon cast out*
		17	*dragon was wroth*
		13:2	*dragon gave his power*
		4	*worshipped the dragon*
		11	*spake as a dragon*
		16:3	*out of the mouth of the dragon*
		20:2	*he laid hold on the dragon*
ἑρπετον	= HERPETON		
	Acts	10:12	*and creeping things*
		11:6	*and creeping things*
	Rom	1:23	*and creeping things*
	Jas	3:7	*every kind of.....serpents*
εχιδνα	= ECHIDNA		
	Mt	3:7	*O generation of vipers*
		12:34	*O generation of vipers*
		23:33	*O generation of vipers*
	Lk	3:7	*O generation of vipers*
	Acts	28:3	*there came a viper out*
Ὄφις	= OPHIS		
	Mt	7:10	*will he give him a serpent?*
		10:16	*wise as serpents*
		23:33	*Ye serpents*
	Mk	16:18	*take up serpents*
	Lk	10:19	*power to tread on serpents*
		11:11	*will he give him a serpent?*
	Jn	3:14	*as Moses lifted up the serpent*
	I Cor	10:9	*were destroyed of serpents*
	II Cor	11:3	*as the serpent beguiled Eve*
	Rev	9:19	*tails were like unto serpents*
		12:9	*old serpent called the Devil*
		14	*from the face of the serpent*
		15	*the serpent cast out of his mouth*
		20:2	*old serpent which is the Devil*

There are 20 Hebrew and 5 Greek words that refer to reptiles in the Bible. A total of 140 reptilian references occur; 103 in the *Old Testament* and 37 in the *New Testament*. The vast majority of references concern snakes (Tables 3 and 4). Seven words appear directly defining lizards. When using specific context, three words mean crocodile: *Tannime*, *Tannine* and *Leviathan*. No direct terminology for the *Chelonia* occurs in the Bible.

The essential features of the herpetological nomenclature appearing in the Bible have been presented. A more detailed examination of reptiles in the Bible will follow in future publications.

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PREPARATION OF LIGAMENTAL SNAKE SKELETONS

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A ligamental skeleton is held together by its own ligaments and has never been disarticulated (taken apart). It is a rather sturdy specimen for something as delicate as a snake skeleton and is not too difficult to prepare.

The best specimens to skeletonize are medium to large in size and either fresh or frozen. A specimen which has started to decay can be utilized if the decomposition has not gone too far. Do not try to skeletonize specimens preserved in alcohol or formalin. Specimens to be skeletonized can be skinned and eviscerated and preserved in brine, or most of the flesh can be removed and the specimens quickly dried in open air for storage. Dry, hard specimens found in nature have usually decayed beyond the point of salvage even though they may appear to be quite fresh. Maceration may be used as an alternative to the following process, but do not attempt to cook a snake skull or skeleton as it will disarticulate.

In cleaning the skeleton, the best way to do most of the cutting is with small scissors. A razor blade can be used, but there is more danger of cutting into bones and ligaments. A not-too-sharp scalpel is good for scraping loosely attached muscle off the larger bones. This loose muscle will be firmly attached in places, but can be clipped off with scissors. Be careful around joints to avoid cutting the ligaments binding the bones together.

Skinning

A single-edged razor blade is a good snake skinning tool and can be discarded when it gets dull. The method of removing the skin is not very important, but some precautions and suggestions are in order. For example, even a dead venomous animal is dangerous if not carefully handled. The potency of the venom is not altered by the death of the animal.

Among other suggestions, it might be said that it is better to remove the skin from the head by starting at the back and pulling the skin forward. It will be necessary to cut the tough connections between skin and skull behind and in front of the eyes, as well as cutting around the edges of the jaws. A little special care is necessary removing the skin from the pits of a pit viper as well as from the nostrils and very front of the skull. When skinning around the cloaca of species having rudamental hind limbs, leave the limbs on the body.

Cleaning the Skeleton

After skinning, cut and gently scrape the flesh from the posterior part of the skull. Twist the head from side to side to see where the skull ends and vertebral column begins. Cut the ligaments at the joint and remove the head. The body may then be frozen until the skull is cleaned. The skull should be cleaned first because if the skull is ruined, you will not have wasted time on a skeleton without a skull.

Skull

Refer to a snake skull or illustration of one before you start to cut to prevent damaging bones or joints. Many bones are so delicate that they can easily be broken with scissors, so it is a good policy to probe with the scissors to locate bones before cutting. If the specimen is venomous, remove the poison glands and tissue in which they are embedded. Rinse out the mouth and nasal passageways. Check the mouth for stomatitis because this common captive snake infection sometimes attacks the bone. Insert the head end of a large pin or small nail into the brain case through the *foramen magnum* (hole through which spinal cord enters skull). Then scoop out the brain with the head of the pin or nail. Do this while holding the head in a stream of water under a faucet. The water entering the foramen magnum will help flush out the brain. Take some forceps and pull on the tissue attached to an eye. Then take some scissors and cut this tissue close to the skull and all around the eye. Continue this process until the eyes have been

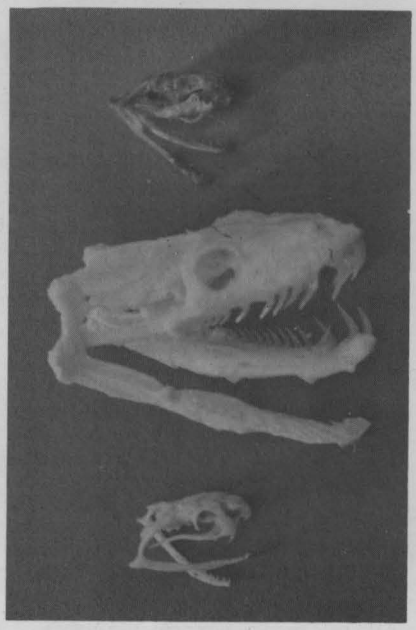


Figure 1. Lateral View of Snake Skulls

The top specimen is a western diamondback rattlesnake's skull (*Crotalus atrox*) which has been roughly cleaned and is ready to be soaked in the ammonia solution. The middle skull is from a reticulated python (*Python reticulatus*), and it has just been taken from the ammonia solution. Notice how bleached out it is when compared with the skull of the rattlesnake. The paleness is due to having had the blood removed from the tissue. This skull is now ready for treatment with a liquid laundry bleach. The bottom skull is from an Asiatic cobra (*Naja naja*) which has been completely cleaned and is ready to be dried.

removed. Remove the tissue between the lower jaw bones and then the lining from the roof of the mouth. As you do this, grasp the soft tissue with forceps and pull it to one side away from a tooth row. Then cut parallel with the row of teeth and as close to them as you can. Periodically you will cut into loose replacement teeth which are embedded in the soft tissue beside the functional teeth. If your specimen has anterior fangs enclosed in a fleshy sheath, cut the sheath in the front and back. Then pull the sheath to the outer side exposing the site of the replacement fangs. Before removing these spare fangs, notice their position behind the functional fangs. Then they may be glued back in place if you so desire. Remove the muscles from the skull by clipping them at one end. Then pull the muscles away from the bones while clipping close to the bones and parallel with the long axes of the muscles and bones. When the other end of the muscles is reached, clip them off. A number of species have easily damaged thin bony ridges on the underside of the braincase, but the collumella is the most delicate of the bones. This thin rod of bone extends from and along the underside of the quadrate to the braincase. The quadrate is the rod-like bone connecting the lower jaw to the also rod-like squamosal bone. The other end of the squamosal bone is attached to the top of the braincase. Carefully clip away the surface connective tissue in the front of the mouth. Continue cleaning the skull in this manner until the bones are quite well exposed. This part of the cleaning process can be extended over several days by refrigerating the specimen when not working on it.

Soaking in Ammonia

The skull can then be soaked in a solution of about half clear or white household ammonia and half water. Do not use ammonia solutions which are colored as they may stain your specimen. The soaking should be done in a bottle with a tight-fitting lid. The skull may be left in the solution for a few hours or months. The soaking will remove blood and puff up the soft tissue. Remove the skull from the solution and rinse it well in water. Then use forceps and small scissors again to remove more soft tissue, but do not attempt to completely clean the skull mechanically. The nasal passages contain some dark tissue, most of which can be removed with forceps, but watch for small curved plates of bone in that area. It is often necessary to treat the skull with a liquid laundry bleach before some of this tissue can be removed. Tough white connective tissue will cover most of the skull, but this can be easily removed by the next process.

Liquid Laundry Bleach Treatment

Rinse the skull with water to remove ammonia before using bleach. Immerse the skull in a liquid bleach solution of from fifty percent bleach and fifty percent water to one hundred percent bleach. The stronger bleach will work faster but must be watched more carefully. The bleach will remove the soft tissue, but if the skull is left in too long, it will disarticulate or dissolve. Do not put the skull in bleach and leave it for even two or three minutes, but stay with it and watch it. After a few minutes, remove the skull from the bleach and put it in water. The bleach will continue acting on the specimen for several minutes even though it is in water.

It may be necessary to mechanically remove more tissue after the bleach treatment and repeat the process a few times. Before you are satisfied that the skull is completely cleaned, remove it from the bleach and soak it in water. Then allow it to dry, and the soft tissue will shrink considerably.

Drying the skull

Place the skull upside down on a clean piece of cardboard or something else flat and soft enough to push pins into. Put pins in front of and behind the skull to hold it in place. Little supports can be made from small pieces of wire bent in such a way that they hold the lower jaws in the proper position. Use your own combination of wires, pins, toothpicks or whatever to hold the skull in the proper position for drying. When dry, the once-floppy skull and jaws will be a rigid unit. If it shifts out of position while drying, the skull or part of it may be relaxed with a few drops and water and repositioned. If the animal was venomous, the spare fangs can be glued in place after the skull is dry. This may not be desirable because it obscures the view of the skull.

Evisceration

Removal of the viscera is not much of a problem, except in the few species which have hind limbs. In the *Boidae*, the pelvic girdle is a rod of bone located along the inner sides of the last three or four ribs. It slants down and supports the single leg bone alongside of the cloaca. Exercise care in this area not to remove these bones with the viscera. Before removing the pelvic girdle and hind limbs, notice their position with reference to the rest of the skeleton. Then you will be able to properly orient them when mounting the skeleton.

Cleaning the Postcranial Skeleton

With the body on its back, much of the muscle can be pulled off the inner side of the ribs with little cutting. Some species have prominent processes (projections) extending down toward the body cavity from the midline of the vertebrae. Avoid damage to these by probing with the scissors before cutting along each side of the processes. Care should also be exercised whenever cutting near the junction of ribs and vertebrae to prevent damage to the ligaments. When about half of the ventral surfaces of the vertebrae and the ribs are exposed, start on the tail. The underside of the tail usually has two longitudinal rows of muscle which are not too difficult to remove. The tail also usually has two rows of spiny projections on each side. These delicate rods of bone are easily damaged. When the caudal vertebrae are beginning to be exposed, place the specimen upright. There is a row of spinous processes along the midline of the back and a rather heavy mass of muscle on each side of this row of bones. Cut along each side of these processes and as close to them as you can. Then this muscle mass can be scraped and cut away from the tops of the vertebrae and ribs. Remove the tough connective tissue from along the tops of the spinous processes and cut down between them. When the greater part

of each vertebra is exposed, clip closely along the front and back edges of each rib. This will release flaps of body wall between adjacent ribs. Pull on these flaps and cut them off as close to the vertebrae as is practical. At the end of this process, spots can be scraped and flesh cut away where necessary.

Ammonia Soak

Treat the skeleton like the skull with household ammonia and water for a few hours or days. Then rinse the skeleton in water and cut and scrape away the thicker soft tissue. Another water rinse is appropriate before proceeding with the process.

Treatment with Liquid Laundry Bleach

As with the skull the strength of the bleach may be varied, and the entire skeleton can be immersed in the bleach. If the skeleton is going to be put in the bleach a section at a time, full strength bleach is recommended. A tooth brush can be used to brush the soft tissue off of the bones as the skeleton is treated with the bleach. Of course, the amount of pressure applied with the brush will depend on how sturdy the skeleton is. A large rattlesnake will take a lot, but a garter snake is more delicate. A long piece of brass or copper wire may be straightened out and pushed into the neural canal of the vertebral column to help dislodge and remove the spinal cord. Take the skeleton out of the bleach while there is still quite a bit of connective tissue between the ribs and vertebral column. Soak the skeleton in water for a few minutes before drying it.

Degreasing

Look for oil on the cleaned and dried skull of the snake. If oil is present, the skull and skeleton should be degreased. Degreasing the specimen is a good policy, but is not really necessary for most snakes. Coil the wet skeleton in a bottle and let it dry for several days. Now put the skull in with the skeleton and cover them with a degreasing solution like carbon tetrachloride. White gasoline can be used, but it is a fire hazard. Most degreasing agents are poisonous and should be used with caution. Avoid breathing the fumes and don't let the solution come in contact with your skin. Cover the bottle and leave it for several days. Then pour off the liquid and let the skull and skeleton dry for a few days.

Final Bleaching

If the specimen is discolored, it can be bleached (especially the soft tissue) with hydrogen peroxide. Stronger commercial solutions of hydrogen peroxide (such as 35%) are very caustic and should be diluted and used with care. The drugstore three percent type is safe to use. The skull and skeleton can be immersed in the hydrogen peroxide for up to about an hour in weaker solutions, but it is wise to watch it. After this treatment, soak the specimen in water for about an hour.

If the post cranial skeleton is dry, relax it in water, lay it on its back and straighten it out. Take some brass, copper, or soft iron wire, pull it out straight and cut off a piece about as long as the snake. Insert the wire into the neural canal of the vertebral column. The wire will not go to the end of the vertebral column, but will go most of the way after some twisting and pulling the wire in and out. When in place, the wire should extend beyond the head end of the skeleton for at least twice the length of the skull.
Bend the skeleton in an appropriate position to fit the board on which you will mount the skeleton. Turn the skeleton upright on a soft board and brace the ribs in the proper position with pins until the skeleton dries. After drying, individual ribs might be relaxed with a few drops of water and be repositioned. When the skeleton is dry remove the pins, and it is ready for mounting.

Mounting

The skeleton may be anchored to the base at three or four places by short pieces of wire. Bend a soft wire into a "U" shape about as wide as a vertebrae and place it between the spinous processes of two vertebrae. Then cross the free ends of the wire under the vertebral column and pull the wire tight against the bones. Now twist the ends of the wire together almost to the level of the free ends of the ribs. Then bend the wire ends toward each other so that they extend straight down under the skeleton and are about three-eighths of an inch apart. When the wires are in place, put the skeleton upright on the board which has been prepared for the base. Mark the places where the wires contact the board, and drill a small hole through the board for each wire. Turn the board over and drill or gouge out a

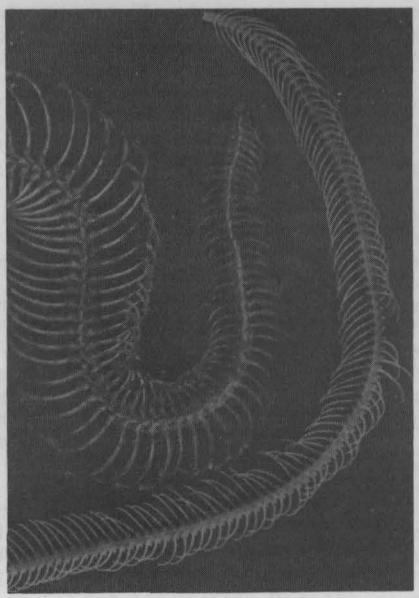


Figure 2. Ventral View of Snake Skeletons

The heavier skeleton has been roughly cleaned and is ready to be treated with an ammonia solution. This specimen is a gaboon viper (*Bitis gabonica*). The more delicate skeleton is that of an Asiatic cobra (*Naja naja*). This skeleton is ready to be dried, but it has been over cleaned. Notice that several ribs have dropped off and several others are partly detached. These ribs will be glued back on after the specimen is mounted.

depression in the bottom between each pair of holes. Push the support wires through the holes, and twist each pair together under the board. Bend the twisted ends over into the depression between the holes. This will allow the board to lay flush on a shelf without the wires interfering or scratching the shelf. Masking tape can be put over the holes on the bottom of the board for added protection to any surface the board is placed upon.

Take the wire extending beyond the front of the skeleton and bend it back one hundred eighty degress making a long narrow loop. This loop of wire should be almost as long as the brain case of the skull. Form the loop in such a way that it must be compressed to enter the foramen magnum, and so that when the compressing force is released, it will hold the skull on the skeleton. When properly adjusted, remove the skull, cut off any excess wire, and replace the skull.

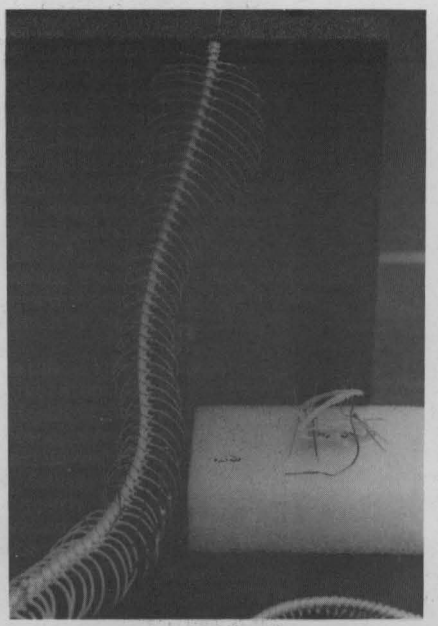
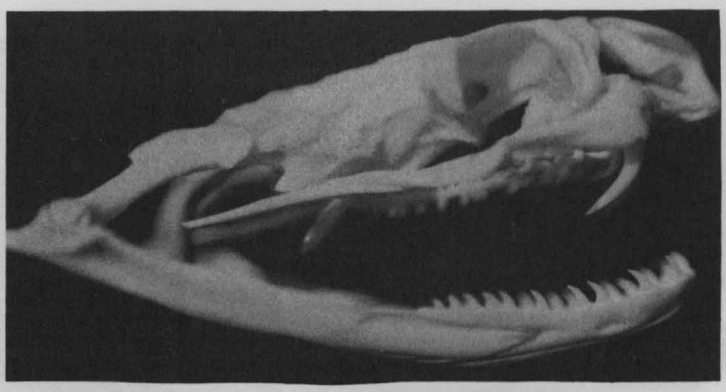


Figure 3. Cobra Skull and Skeleton

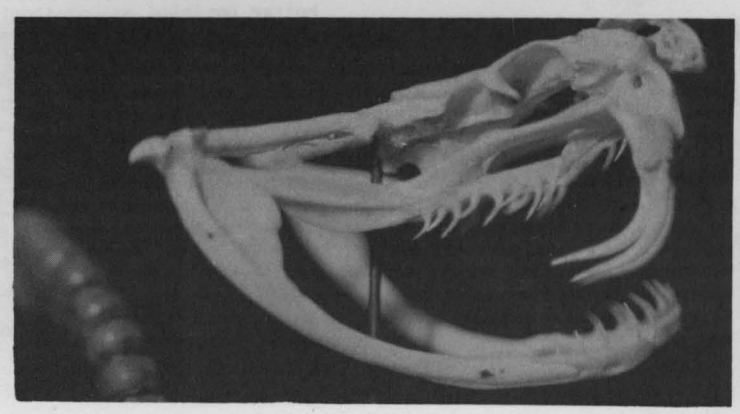
The skull and skeleton are held in place by pins and wire. When dry, individual joints may be relaxed with a few drops of water and the bones shifted to a better position.

King Cobra



Burmese
Rock
Python

Eastern
Diamondback
Rattlesnake



AMPHIBIAN AND REPTILIAN REPRODUCTION

This section is for publishing courtship, breeding and/or birth data. All data submitted is published un-edited and includes information such as: field notes, gestation periods, incubation times, animal size, sex ratios, courtship behavior, ontogenetic changes..etc.... Short comments by the author may be included.

REPTILIAN REPRODUCTION NOTES

K. S. MATZ

UU = University of Utah Dept. of Herpetology
KSMPC = K. S. Matz Private Collection
DOR = Dead on road
AOR = Alive on road

Agkistrodon contortrix mokeson - northern copperhead
1. KSMPC 225; UU - 12391
(Captive) October, 1962 - two young stillborn
2. KSMPC 512; UU - 12390
(Captive) October 13, 1964 - expelled one dead embryo surrounded with hardened yolk, contained two similar embryos

Coluber constrictor constrictor - eastern black racer
1. KSMPC 290; UU - 12337
(Captive) May 31, 1963 - eggs visible through body wall
June 13, 1963 - two eggs laid
June 15, 1963 - one egg laid
June 16, 1963 - one egg laid
June 17, 1963 - sixteen eggs laid
Total = 20 eggs all white, smooth, non-adhering and infertile

Coluber constrictor mormon - western racer
1. KSMPC 104
(Captive) July 2, 1962 - five eggs laid
2. KSMPC 114
(Captive) July 2, 1962 - five eggs laid

3. May 27, 1974 - found DOR female with more recent DOR male, AOR
(Field) male found in contact with both DOR

Dasypeltis scabra - egg-eating snake
1. KSMPC 536
(Captive) October 13, 1970 - laid nine eggs, mean dimension 16.55 mm x 29.77 mm

Eumeces fasciatus - five-lined skink
1. KSMPC 333; UU - 12291
(Field) July 25, 1963 - found near cluster of eight eggs

Masticophis taeniatus taeniatus - desert whipsnake
1. KSMPC 206
(Captive) June 30, 1962 - laid six eggs

Pituophis melanoleucus deserticola - Great Basin gopher snake
1. KSMPC 205; UU - 12346
(Captive) July 5, 1962 - laid six eggs
2. KSMPC 329;
(Field) July 21, 1963 - appeared to have laid eggs just prior to being collected

3. KSMPC 544
(Field) May 27, 1974 - found DOR female with AOR male attempting copulation, contained eleven partially developed eggs of which four were much less developed.

4. Breeding Note
(Field) June 23, 1974 - found copulating pair in burrow, three to four inches of tails outside burrow

Thamnophis elegans vagrans - wandering garter snake
1. KSMPC 31
(Captive) August 9, 1961 - gave birth to young
one (KSMPC 52) measured S-V 11.5 cm, tail 3.7 cm

Thamnophis sirtalis infernalis - California red-sided garter snake
1. Dept. of Herpetology, U of U
(Captive) July 6, 1970 - twenty-seven young born

Thamnophis sirtalis semifasciatus - subspecies of eastern garter snake
1. KSMPC 453; UU - 12322
(Captive) June 29, 1964 - contained 30 young

Uta stansburiana stansburiana/stejnegeri - side blotched lizard
1. KSMPC 472
(Captive) July 1, 1964 - laid four eggs
July 2, 1964 - laid one egg

Vipera berus - European viper
1. KSMPC 514; UU - 12384
(Captive) September 9, 1964 - contained thirteen young
2. Uncat. female
(Captive) September 9, 1964 - gave birth to twelve young not more than two days previous

306 L Street
Salt Lake City, Utah 84103

Boidae Reproduction Data

MIKE COFFEEN

Epicrates cenchria maurus (Columbian rainbow boa)

Breeding dates: (Male introduced to female Nov. 5, 1973)

1973: Nov. 14, 15, 19, 25, Dec. 8, 9, 19, 27, 30, 31
1974: Jan. 7

Note: gravidity apparent, early January 1974.

Birth = June 13, 1974 (AM) 2 males + 6 females (gestation = 6-7 months)

	Range	Mean	Variance	Std. Dev.	Std. Error of Mean	# Specimens
Combined Sexes						
Length (inches)	15.5-17.0	15.9	0.1	0.2	0.150	8
Weight (grams)	28.8-33	31.7	3.6	1.9	1.351	8

Note - 1. Young are vividly marked.
2. No significant difference in size by sex (only 2 males for comparison).

Constrictor constrictor imperator (Central American boa) male
+
Constrictor constrictor constrictor (common boa) female

Breeding: April 12, 1973

Gravidity apparent, late May 1973

Birth: September 30, 1973 (5 1/2 months gestation), 18 young hybrids

parent female = 60" c.c.c., 25 dorsal blotches to vent, 3 blotches vent to tail

	Range	Mean	Variance	Std. Dev.	Std. Error of Mean	# Specimens
Combined Sexes						
Length (inches)	18-19	18.6	0.2	0.4	0.097	18
Weight (grams)	57-70	64.5	12.5	3.5	0.833	18
Dorsal blotches to vent.	24-27	25.6	0.6	0.8	0.183	18
Dorsal blotches tail	3-5	4.06	0.4	0.6	0.151	18

	Range	Mean	Variance	Std. Dev.	Std. Error of Mean	# Specimens
Males						
Length (inches)	18-19	18.7	0.2	0.4	0.128	12
Weight (grams)	59-69	65.0	8.2	2.9	0.826	12
Dorsal blotches to vent.	25-27	25.9	0.4	0.7	0.193	12
Dorsal blotches tail	4-5	4.33	0.2	0.5	0.142	12
Females						
Length (inches)	18-19	18.6	0.1	0.4	0.154	6
Weight (grams)	57-70	63.5	22.7	4.8	1.945	6
Dorsal blotches to vent.	24-26	25.0	0.4	0.6	0.258	6
Dorsal blotches tail	3-4	3.5	0.3	0.6	0.224	6

Reptile Department
Hogle Zoological Gardens
Salt Lake City, Utah 84110

Viperidae Reproduction Data

JIM GLENN

Vipera russellii siamensis (Russells viper ssp.)

From: Bangkok, Thailand (wild bred)

(2 gravid females)

VRS #1 = Birth = June 11, 1974, 29 young (AM)

	Range	Mean	# Specimens
Combined Sexes			
Length (inches)	10-10.9	10.51	29
Weight (grams)	13-17.3	15.63	29
Males			
Length (inches)	10.25-10.9	10.54	21
Weight (grams)	14.1-17.3	15.85	21
Females			
Length (inches)	10.25-10.6	10.43	8
Weight (grams)	12.9 -15.7	15.04	8

VRS #2 Birth = June 13, 1974, 13 alive, 2 dead + 5 infertile eggs. (AM)

	Range	Mean	# Specimens
Combined Sexes			
Length (inches)	9.3-10.5	9.87	13
Weight (grams)	10.4-13.8	12.50	13
Males			
Length (inches)	9.9-10.5	10.1	5
Weight (grams)	11.6-13.8	13.06	5
Females			
Length (inches)	9.3-10.1	9.73	8
Weight (grams)	10.4-13.6	12.13	8

Venom Research Laboratory
Veterans Administration Hospital
Salt Lake City, Utah 84110

Crotalus Viridis Concolor (midget faded rattlesnake)

James L. Glenn

Very little information has been published concerning the midget faded rattlesnake, especially reproduction data. The birth of 7 young by this sub-species in our laboratory may be the first recorded in captivity. Therefore the individual snake data is presented instead of the usual pooled information.

Crotalus viridis concolor, Woodbury 1929 - Sept. 18, 1973, 7 young born 7:30 a.m. - 11:30 a.m., wild bred.

	Parent	#1	#2	#3	#4	#5	#6	#7 (Runt)
Sex	F	F	F	F	M	F	M	F
Length (inches)	21.5	7.0	6.5	7.25	7.75	7.3	7.75	5.5
Weight (grams)	160/95*	7.35	7.35	7.30	7.25	7.6	7.3	3.4
Ventrals		166	168	169	175	170	165	165
Dorsal Blotches to vent	38	37	39	41	44	40	39	37
Tail bands	7	7	8	7	11	7	10	7
Mid dorsal rows	-	25	24	23	23	25	23	24
Mid dorsal caudal rows	-	14	16	13	13	15	12	-
Sub caudals	-	16	16	17	24	18	23	15

*before/after birth of young

Notes:

1. Young are vividly marked, very docile.

2. The males were longer than females (adult males attain greater length and bulk than females).

3. Dorsal blotches more uniform than lutosus or viridis.

4. Runt (#7) lacked complete ventral formation (line down center of ventrals), underdeveloped.

5. The venom of this species is one of the most toxic among the *Crotalidae* (to be published).

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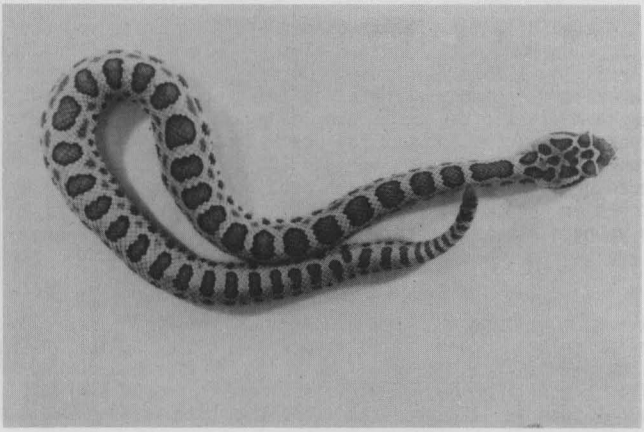
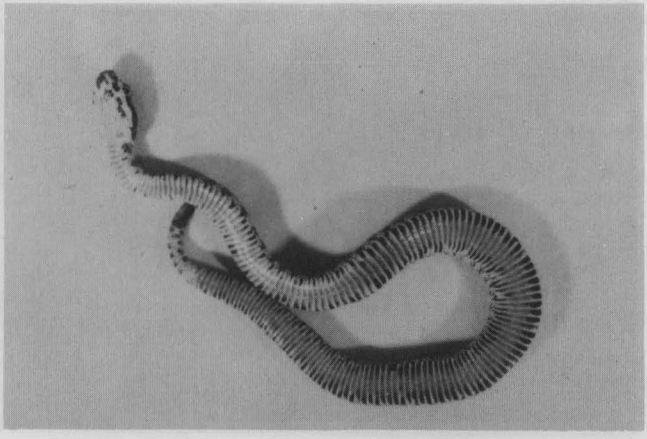


Dorsal view of a 2 day old, *Crotalus viridis concolor*



Ventral view of a 2 day old, *Crotalus viridis concolor*

BANDED KRAIT (*BUNGARUS FASCIATUS*) BIRTH DATA

JAMES L. GLENN

A gravid 1670 mm female banded krait was received from Bangkok, Thailand on March 27, 1973. A clutch of 16 eggs was produced by the snake on April 14, 1973. Twenty-four days later, 14 of the eggs were ruined in a laboratory accident. The 2 remaining eggs had been kept in a separate area in a plastic bag containing dampened peat moss and wet paper towels. Temperature of the incubating substrate (peat moss) was maintained at 77-83° F throughout the incubating period. The peat moss was dampened every 7 days as needed. Air humidity above the peat moss ranged from 40-65%. The two eggs hatched on June 14th and June 15th. Two unique features were outstanding in the young's appearance compared to the adults. The tapered tail (very blunt in adults) and the faded appearance of the white bands (even after eccdysis).

The female hatchling died 1 week following birth. The male was kept alive by tube feeding the snake for 1 year and 3 days. The diet consisted of beef or chicken broth, vitamins and egg mixture. The snake succumbed 24 hours following its first voluntary meal, consisting of one 30.5 cm western yellow-bellied racer (*Coluber constrictor mormon*), due to suffocation. During the year of tube feeding the snake continually refused young mice.

Adult female length: 1670 mm
Eggs deposited: 16 on 4/14/73
Hatched: 6/14 and 6/15 (incubation time = 61 and 62 days)
Young total length: male = 338 mm
female = 356 mm
Young weight: both male and female = 17.2 grams

Eccdysis: 11 and 13 days following birth

Recommended related reading:

1. Taylor, E. H. The Serpents of Thailand and Adjacent Waters in Univ. Kans. Sc. Bull. Vol XLV, No. 9, June, 1965. pp 943-946.

2. Tweedie, M. W. F. The Snakes of Malaya Government Pub. Bureau, Singapore, 1957, pp 93-94.

3. Werler, J. E. and Keegan, H. L. Venomous Snakes of the Pacific Area in Venomous and Poisonous animals and Noxious Plants of the Pacific Region, 1963, Pergamon Press.

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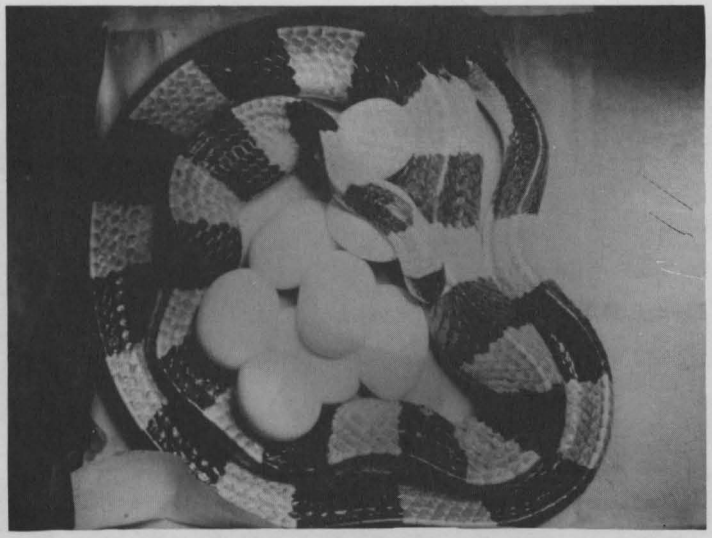
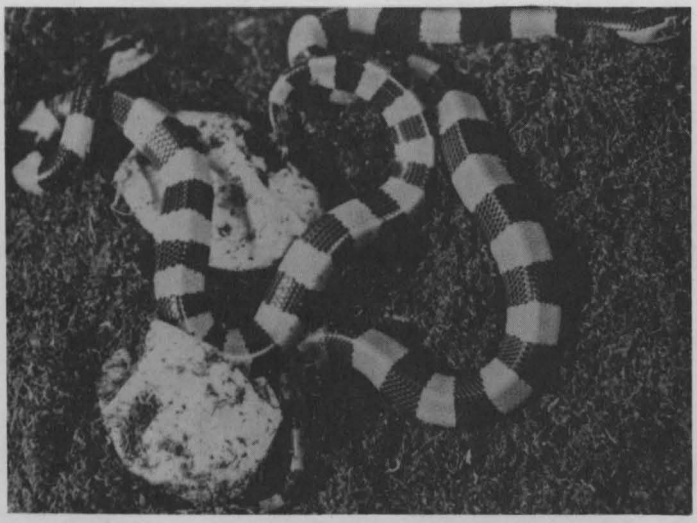
and
Hogle Zoological Gardens
Salt Lake City, Utah



Banded Krait in process of laying a clutch of 16 eggs.



Banded Krait hatchlings, following emergence from eggs.

COMMONWEALTH SERUM LABORATORIES

ANTIVENENES

The following information is presented due to the recent interest in the cross-neutralization afforded by Commonwealth's Antivenenes, "*Tiger Snake*" and "*Polyvalent (Aust/NG)*".* The August 1974 price list of all Commonwealth Antivenenes

*References

1. Baxter, E. H. and Gallichio, H. A., Commonwealth Serum Laboratories, Parkville, Victoria 3052, Australia. *Cross-Neutralization by Tiger Snake (Notechis Scutatus) Antivenne and Sea Snake (Enhydrina Schistosa) Antivenene Against Several Sea Snake Venoms*, Toxicon 12:273-278, Pergamon Press, 1974.

2. Minton, S. A., Microbiology Department, University Medical Center, Indianapolis, Indiana. *Paraspecific Protection by Elapid and Sea Snake Antivenins*, Toxicon 5:47, Pergamon Press, 1967.

3. Minton, S. A. Personal communication, mimeograph handout to zoos by request (to be published).

Antivenene	Approx. Average Volume	A$ FOB MELB.	US$ FOB MELB.
Black Snake (18,000 units)	40.3 ml	71.61	107.41
Brown Snake (500 units)	1.1 ml	10.50	15.75
Death Adder (6,000 units	25.5 ml	44.08	66.12
Polyvalent (Aust/NG) (39,500 units)	36 ml	97.42	146.13
Red Back Spider (500 units/ml)	1.1 ml	3.00	4.50
Sea Snake (1,000 units)	35.8 ml	62.50	93.75
Sea Wasp (20,000 units)	3.3 ml	12.50	18.75
Stone Fish (2,000 units/ml)	2.3 ml	7.50	11.25
Taipan (12,000 units/ml)	44.5 ml	90.65	136.00
Tiger Snake (3,000 units)	8.4 ml	15.95	23.92

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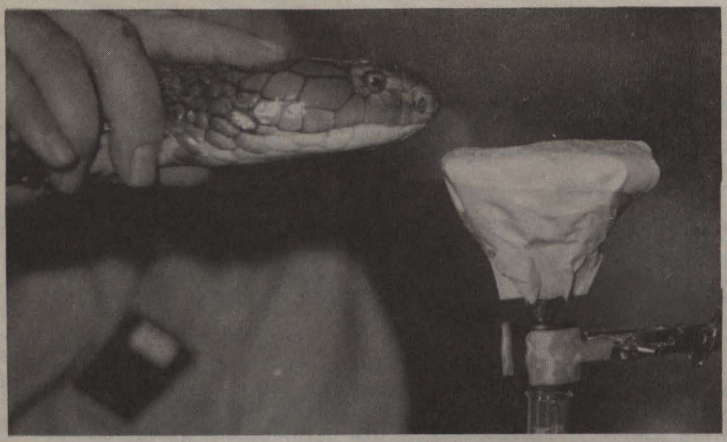
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